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ERRATUM: "STELLAR HALO PARAMETERS FROM 4588 SUBDWARFS" (ApJ, 583, 765 [2003])

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An error has been discovered in the computer program that determined the stellar halo parameters using ∼4500 halo stars drawn from the revised New Luyten Two-Tenths catalog. None of the major scientific conclusions of that paper are qualitatively altered. In particular, five of the nine velocity-ellipsoid parameters remain consistent with zero within their small errors. However, many individual parameters have changed their values by 1 or 2 σ and a few by more. I explain the nature of the error and give corrected values for the parameters.

The ∼4500 halo stars analyzed were selected from the revised New Luyten Two-Tenths catalog (A. Gould & S. Salim, ApJ, 582, 1001 [2003]; S. Salim & A. Gould, ApJ, 582, 1011 [2003]) by demanding that the reduced proper motion (RPM) discriminator,

$$\eta \equiv V - 5\log(\mu) - 3.1(V-J) - 1.47|\sin b| - 2.73, \tag{1}$$

lie within the secure halo range, $1 \le \eta \le 4.15$. Here μ is the proper motion in arcsec per year and b is the Galactic latitude. A programming error inadvertently multiplied b by a factor 10, thereby scattering about 10% of the halo sample out of the selection interval and also scattering a roughly equal number of stars in the other direction, i.e., into the selection range (see Fig. 1). The error affected only the selection process and did not affect the analysis of the selected stars.

After correcting this error, I find that the total sample is very slightly reduced to 4564 stars. The revised fit parameters typically differ from those in the original paper by 1 to 2 σ. Because the sample size does not significantly change, the error estimates also do not change. The new estimates of the parameters are as follows. The luminosity function (LF) in 1 mag intervals $M_V = 3,\ 4,\ \ldots,\ 15$ is given by $\Phi(M_V) = (0.03, 0.17, 0.49, 0.61, 0.64, 0.86, 2.24, 4.66, 4.50, 2.57, 2.07, 1.66, 1.53) \times 10^{-5}$ pc^{-3} (see Fig. 2). The bulk motion of the halo relative to the Sun is $U_1 = 8.5 \pm 2.2$ km s^{-1} and $U_3 = -7.5 \pm 2.4$ km s^{-1} in the radial (outward) and vertical (upward) directions, respectively. The diagonal components of the velocity dispersion tensor are $(c_{ii} + \Delta c_{ii})^{1/2} = (167.9 \pm 1.4,\ 113.0 \pm 1.7,\ 88.6 \pm 1.9)$ km s^{-1}, where Δc_{ii} is defined by equation (12) of the original paper. The correlation coefficients of the velocity-ellipsoid tensor are

$$(\tilde{c}_{12}, \tilde{c}_{13}, \tilde{c}_{23}) = (0.008 \pm 0.014,\ 0.014 \pm 0.023,\ -0.039 \pm 0.026). \tag{2}$$

The two parameters of the halo density profile, $\rho \propto (R/R_0)^{-\nu}\exp(-\kappa|z|)$, become $\nu = 2.7 \pm 1.0$ and $\kappa = 0.019 \pm 0.057$ kpc^{-1}. Here R is Galactocentric distance, z is height above the Galactic plane, and $R_0 = 8$ kpc is the solar Galactocentric distance. The

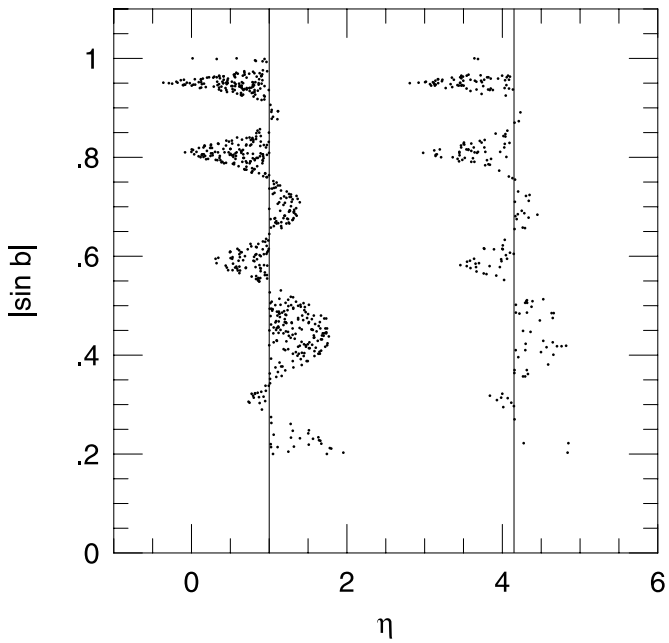

Fig. 1.—Correction of a computer bug implementing the selection criterion $1 \le \eta \le 4.15$ (*vertical lines*), where η is defined by eq. (1). The 444 stars that were incorrectly included in the original analysis lie outside these boundaries, while the 424 that were incorrectly excluded lie inside. Since stars with $0 \le \eta \le 5.15$ are mostly halo stars (S. Salim & A. Gould, ApJ, 582, 1011 [2003]), the previous substitution of "contaminating" stars for a roughly equal number of proper members of the sample did not have much effect on the measurement of halo parameters.

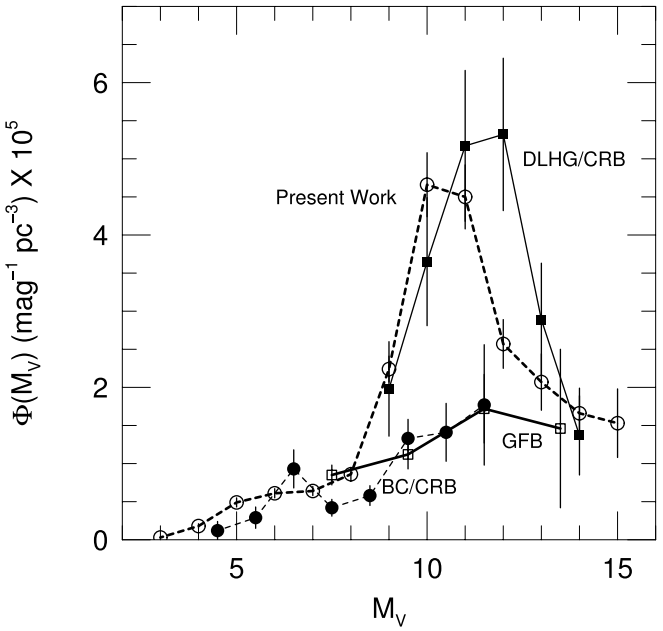

FIG. 2.—Comparison of four halo LFs (revised from Fig. 2 of original paper): the original determinations by C. C. Dahn et al. (1995, in An ESO Workshop on the Bottom of the Main Sequence and Beyond, ed. C. G. Tinney [Heidelberg: Springer], 239; DLHG) and J. N. Bahcall & S. Casertano (ApJ, 308, 347 [1986]; BC) have been rescaled by A. Gould, C. Flynn, & J. N. Bahcall (ApJ, 503, 798 [1998]) using the velocity ellipsoid of S. Casertano, K. Ratnatunga, & J. N. Bahcall (ApJ, 537, 435 [1990]; CRB). The revised version continues to confirm the "bump" in the LF found by DLHG at $M_V \sim 11$ as well as the fall-off toward brighter magnitudes found by J. N. Bahcall & S. Casertano (ApJ, 308, 347 [1986]), but with much smaller error bars in both cases.

color-magnitude relation parameters are virtually unchanged, $a = 3.59$ and $b = 0.69$. Finally, the completeness function is expressed by a break at a virtually unchanged $V_{\rm break} = 18.27$, but with the completeness at this break point rising to 50% ± 6%.

In particular, the motion of the local standard of rest (LSR) relative to the halo is

$$V_1 = 1.5 \pm 2.2 \text{ km s}^{-1}, \qquad V_3 = 0.3 \pm 2.4 \text{ km s}^{-1}. \tag{3}$$

Hence, as originally claimed, all five velocity-ellipsoid parameters in equations (2) and (3) are consistent with zero. Thus, $\chi^2 = 3.43$ for 5 degrees of freedom, slightly less than the previous value (3.97). This implies that the limits on stellar-halo granularity derived in a subsequent paper from this statistic remain essentially unaltered, being about 2% tighter (see eq. [9] of A. Gould, ApJ, 592, L63 [2003]).

Four of the 27 parameters do change by more than 2 σ. Both $(c_{11} + \Delta c_{11})^{1/2}$ and $(c_{22} + \Delta c_{22})^{1/2}$ increase by 4 σ. However, because the Δc_{ii} are poorly constrained, these parameter-combination measurements did not give any useful information about the halo, and this remains so with the new determinations. The LF bins at $M_V = 10$ and $M_V = 11$ each decline by 3 σ, which leaves a somewhat lower but still pronounced peak in the LF at these magnitudes (see Fig. 2).

It seems strange at first sight that a 10% contamination of the sample would generally have such a small effect. The explanation lies in the conservative selection of the original sample. As shown by Figure 1, almost all of the contaminating stars came from the range $0 < \eta < 5.15$, even at the edges of which the majority of stars are in the halo. Hence, the "contaminants" did not alter the basic character of the sample.

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